

09/980439

Attorney Docket No. OUTO 2367

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CHAPTER II

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED
OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

<u>PCT/FI00/00553</u>	<u>20 June 2000 (20.06.00)</u>	<u>29 June 1999 (29.06.99)</u>
INTERNATIONAL APPLICATION NO	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED

ARRANGEMENT FOR MEASURING CONCENTRATE FLOW IN CONNECTION WITH
A FLOTATION CELL

TITLE OF INVENTION

Eljas SAASTAMOINEN (Helsinki, Finland)

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APPLICANT(S)

Box PCT
U.S. PATENT AND TRADEMARK OFFICE
P.O. Box 2327
Arlington, Virginia 22202

Attention: EO/US

1. This national phase application claims priority of the following national application(s):

Finnish Patent Application No. 991484 filed June 29, 1999.

2. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 USC 371:

- A. ☒ This express request to immediately begin national examination procedures (35 USC 371(f)).
- B. ☒ The U.S. National Fee (35 USC 371(c)(1) and other fees (37 CFR 1.492) indicated in the attached fee calculation sheet.

3. ☒ A copy of the International application as filed [35 USC 371(c)(2)]:

- a. ☐ is transmitted herewith.
- b. ☐ is not required as the application was filed with the United States Receiving Office.

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- c. ☒ [x] has been transmitted
- i. ☒ [x] by the International Bureau. Date of mailing of the application (from form PCT/IB/308): 04 January 2001 (04.01.01).
- ii. ☐ [] by applicant on (date) _____.
4. ☒ [x] A translation of the International application into the English language [35 USC 371(c)(2)]:
- a. ☐ [] is transmitted herewith.
- b. ☒ [x] is not required as the application was filed in English.
- c. ☐ [] was previously transmitted by applicant on (date) _____.
- d. ☐ [] will follow (within 32 months of earliest priority date).
5. ☒ [x] Amendments to the claims of the International application under PCT Article 19 [35 USC 371(c)(3)]:
- a. ☐ [] are transmitted herewith.
- b. ☐ [] have been transmitted
- i. ☐ [] by the International Bureau. Date of mailing of the amendment (from form PCT/IB/308): _____.
- ii. ☐ [] by applicant on (date) _____.
- c. ☒ [x] have not been transmitted as
- i. ☒ [x] applicant chose not to make amendments under PCT Article 19. Date of mailing of Search Report (from form PCT/ISA/210): 16 October 2000 (16.10.00).
- ii. ☐ [] the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.
6. ☒ [x] A translation of the amendments to the claims under PCT Article 19 [35 USC 371(c)(3)]:
- a. ☐ [] is transmitted herewith.
- b. ☐ [] is not required as the amendments were made in the English language.
- c. ☒ [x] has not been transmitted for reasons indicated at point 5c above.

7. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409)
 - a. ☒ is transmitted herewith.
 - b. ☐ is not required as the application was filed with the United States Receiving Office.
8. ☒ Annex(es) to the International Preliminary Examination Report
 - a. ☒ is/are transmitted herewith.
 - b. ☐ is/are not required as the application was filed with the United States Receiving Office.
 - c. ☐ is/are not being transmitted as there is/are no Annex(es).
9. ☒ A translation of the annexes to the International Preliminary Examination Report
 - a. ☐ is transmitted herewith.
 - b. ☒ is not required as the annexes are in the English language.
 - c. ☐ is not being transmitted for the reason indicated at point 8c above.
10. ☒ An oath or declaration of the inventor [35 USC 371(c)(4)] complying with 35 USC 115
 - a. ☐ was previously submitted by applicant on (date) _____.
 - b. ☐ is submitted herewith and such oath or declaration
 - i. ☐ is attached to the application
 - ii. ☐ identifies the application and any amendments under PCT Article 19 which were transmitted as stated in points 5a or b; and states that they were reviewed by the inventor as required by 37 CFR 1.70.
 - c. ☒ will be provided in response to a Notice to File Missing Requirements.
11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):
 - a. ☐ is transmitted herewith.
 - b. ☒ has been transmitted by the International Bureau. Date of mailing (from form PCT/IB/308): 04 January 2001 (04.01.01).
 - c. ☐ is not required as the application was searched by the United States International Searching Authority.
 - d. ☐ will be transmitted promptly upon request.

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e. ☐ has been submitted by applicant on (date) _____.

12. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98:

a. ☐ is transmitted herewith.

Also transmitted herewith is

☐ Form PTO-1449

☐ Copies of citations listed

b. ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 USC 371(c).

c. ☐ was previously submitted by applicant on (date) _____.

13. ☐ The applicant claims small entity status with respect to this application.

☐ A Verified Statement Claiming Small Entity Status is attached.

☐ The undersigned claims small entity status on behalf of the applicant.

14. ☐ An assignment document is transmitted herewith for recording. A separate ☐ "RECORDATION COVER SHEET" is also attached.

15. ☒ Additional documents

a. ☐ Copy of request (PCT/RO/101)

b. ☒ International Publication No. WO 01/01080

i. ☐ Specification, claims and drawing

ii. ☒ Front page only

c. ☒ Preliminary amendment

d. ☒ Abstract

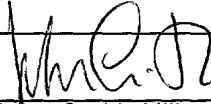
e. ☐ Other

16. ☒ The above checked items are being transmitted

a. ☒ before 30 months from any claimed priority date.

b. ☐ after 30 months but before 32 months (surcharge and/or processing fee included) from any claimed priority date.

17. ☐ Certain requirements under 35 USC 371 were previously submitted by the applicant on _____, namely:



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JC10 Rec'd PCT/PTO 29 NOV 2001

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Elja SAASTAMOINEN et al

Art Unit:

Application No:

Examiner:

Filed:

For: ARRANGEMENT FOR MEASURING CONCENTRATE
FLOW IN CONNECTION WITH A FLOTATION
CELL

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Please make the following amendments to this application prior
to examination thereof.

AMENDMENTS

In the Claims:

Claims 3-9, cancel

Add new claims as follows:

10. (New) An apparatus according to claim 1, characterized in
that the sensor element is attached to the horizontal axis of the
measuring device.

11. (New) An apparatus according to claim 1, characterized in
that the horizontal axis of the measuring device is positioned
essentially transversely to the flowing direction of the concentrate
flow to be measured.

12. (New) An apparatus according to claim 1, characterized in
that the arrangement is connected to the control system of the
flotation cell.

13. (New) An apparatus according to claim 1, characterized in
that the arrangement comprises a display unit.

14. (New) An apparatus according to claim 1, characterized in that the concentrate flow to be measured is the flow flowing out of a flotation cell via a drain chute.


15. (New) An apparatus according to claim 1, characterized in that in the sensor element, there is arranged a calibration means, such as a movable weight.

16. (New) An apparatus according to claim 1, characterized in that the arrangement is provided in connection with the drain chute of a flotation cell, preferably so that the sensor element is at least partly placed in a collecting pipe.

REMARKS

The above amendments are presented in order to place this application in better condition for examination.

Respectfully submitted,



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Docket: OUTO 2367

CLAIMS

1. An arrangement for measuring concentrate flow in connection with a flotation cell, in which flow the slurry and liquid, formed of the foam of flotation
5 cell and having different densities, are at least partly in layers, **characterized** in that said arrangement comprises an elongate sensor element (1) extending essentially over the whole transversal area of the material flow to be measured, and a measuring device (2) for detecting the position of the sensor element (1).
- 10 2. An arrangement according to claim 1, **characterized** in that the measuring device (2) is an angle transmitter.
3. An apparatus according to claim 1 or 2, **characterized** in that the sensor
15 element (1) is attached to the horizontal axis (3) of the measuring device (2).
4. An apparatus according to any of the preceding claims 1 - 3, **characterized** in that the horizontal axis (3) of the measuring device (2) is positioned essentially transversally to the flowing direction of the concentrate flow to be
20 measured.
5. An apparatus according to any of the preceding claims 1 - 4, **characterized** in that the arrangement is connected to the control system (6) of the flotation
cell.
- 25 6. An apparatus according to any of the preceding claims 1 - 5, **characterized** in that the arrangement comprises a display unit (7).
7. An apparatus according to any of the preceding claims 1 - 6, **characterized**
30 in that the concentrate flow to be measured is the flow (13) flowing out of a flotation cell via a drain chute (8).

8. An apparatus according to any of the preceding claims 1 - 7, **characterized** in that in the sensor element (1), there is arranged a calibration means (4), such as a movable weight.

5

9. An apparatus according to any of the preceding claims 1 - 8, **characterized** in that the arrangement is provided in connection with the drain chute (8) of a flotation cell (11), preferably so that the sensor element (1) is at least partly placed in a collecting pipe (10).

10

ARRANGEMENT FOR MEASURING CONCENTRATE FLOW IN CONNECTION WITH A FLOTATION CELL

The present invention relates to an arrangement according to the preamble of
5 claim 1 for measuring material flow, particularly concentrate flow, in connection with a flotation cell.

In connection with flotation cells, the measuring of the quantity of flotation concentrates has been difficult, owing to the air content of said concentrates,
10 among others. Conventional quantity meters, such as the V-dam measuring, have turned out to be unreliable when used in connection with flotation cells. In the drain pipe, located in succession to the drain chute, the slurry and liquid, formed of the foam of flotation cells and having different densities, are typically at least partly in layers, which has made the reliable measuring of mass flow
15 more difficult. Indirect calculatory methods have likewise proved to be either unreliable or else there is too much delay for a rapid adjusting of the operation of the flotation cell.

The object of the invention is to realize a completely new arrangement for
20 measuring the mass flow of flotation concentrate, whereby the drawbacks of the prior art can be avoided.

The invention is characterized by what is set forth in the appended claims. The arrangement according to the invention is characterized in that the
25 arrangement comprises an elongate sensor element that extends essentially over the whole transversal area of the material flow to be measured, and a measuring device for detecting the position of the sensor element.

According to a preferred embodiment of the invention, the measuring device is
30 an angle transmitter. A preferred embodiment of the invention is characterized in that the sensor element is attached to the horizontal axis of the measuring device.

- Another embodiment of the invention is characterized in that the horizontal axis of the measuring device is positioned essentially transversally with respect to the flowing direction of the material flow to be measured. The material flow to be measured is advantageously the material flow that flows out of the flotation cell via a drain chute. In a preferred embodiment, the arrangement is provided in connection with the drain chute of a flotation cell, preferably so that the sensor element is at least partly located in the collecting pipe.
- 10 The arrangement is typically connected to the control system of the flotation cell. Advantageously the arrangement comprises a display unit. In a preferred embodiment, the sensor element is provided with a calibration means, such as a movable weight.
- 15 The arrangement according to the invention has several remarkable advantages. The arrangement according to the invention is well suited to be used in connection with flotation cells. The arrangement is secure in operation, simple in structure and easily applied to various different flotation cells. By means of the sensor element arrangement, there is achieved a good measuring reliability, which has been proved by tests that were carried out. The sensor element reacts well to changes in the material flow, and it is not too sensitive to local changes of velocity. Owing to the small area of the sensor element, the force that is directed to the sensor element by lighter materials with a lower density is relatively small in comparison with the force directed to said sensor element by heavier materials with a higher density. Thus the sensor element is well suited to measure the quantities of concentrate flowing out of flotation cells. The information given by the measuring device can easily be applied when controlling the operation of the flotation cell. By means of the calibration means arranged in the sensor element, the arrangement according to the invention can be applied to many different usages, and to measuring material flows with varying characteristics.

In the present specification, the term flotation cell means a unit composed of a flotation mechanism, chutes and tank.

The invention is explained in more detail with reference to the appended
5 drawings, where

figure 1 illustrates a preferred embodiment of the arrangement according to the invention,

figure 2 illustrates the measuring device and sensor element of the arrangement according to the invention, and

10 figure 3 illustrates the measuring device and sensor element of the arrangement according to the invention, seen in the direction A - A of figure 2.

In figure 1, there is illustrated only part of an arrangement connected to the removal of froth from a flotation cell. It is assumed that a flotation cell
15 represents technology known as such for a man skilled in the art, wherefore it is not explained in more detail in the present specification. A known flotation cell is described in the patent publication CA 1,218,772.

The arrangement according to the invention for measuring material flow,
20 particularly concentrate flow, in connection with a flotation cell comprises an elongate sensor element 1, which extends essentially over the whole transversal area of the material flow to be measured, and a measuring device 2 for detecting the position of the sensor element 1. In the embodiment illustrated in the drawings, the sensor element 1 is at the top part arranged in
25 the horizontal axis 3 of the measuring device 2. The horizontal axis 3 of the measuring device 2 is positioned essentially transversally with respect to the flowing direction 13 of the material flow to be measured. Typically the measuring device 2 is an angle transmitter.

30 The arrangement is installed in connection with the drain chute 8 of the flotation cell 11, preferably in a collecting pipe 10. In the embodiment of figure 1, the arrangement is installed at the edge of the flotation cell 11, above the

collecting pipe 10, by means of an installation frame 12. The arrangement is set to measure the quantity of concentrate in the material flow entering the collecting pipe 10 through the aperture of the drain pipe 9 from the chute 8 of the flotation cell 11. From the collecting pipe 10, the material flow is conducted, via an aperture 14, to further treatment.

The measuring method applied by the arrangement is based on a change in the position of the elongate, narrow sensor element 1, which change is transmitted to the angle transmitter 2 or the like. Most advantageously the sensor element 1 is attached to the axis 3 of the angle transmitter 2 and hangs in free downwardly suspension from the fastening point. The position of the sensor element 1 is continuously changed along with the changes taking place in the concentrate flow 13. The angle transmitter 2 registers the changes in the sensor element 1 as a turn β of the horizontal axis 3, and transmits the information of the change to the display 7 and/or to the control system 6 of the flotation cell. The arrangement according to the invention is particularly well suited to observing changes in the relative flowing of concentrate. In a preferred embodiment, the angle transmitter 2 used as the measuring device is a potentiometer, the output current whereof is changed as the position of the sensor element 1 changes. The measuring device is calibrated to level zero when the sensor element 1 hangs in a vertical position. In a typical situation, the strengthening of the flow 13 is observed for instance as a change in the position of the sensor element 1 in percentages with respect to the zero level.

An essential feature in the operation of the arrangement according to the invention is that the sensor element cuts the slurry flow 13 in a narrow area and penetrates the slurry flow in the vertical direction. Now the sensor element 1 reacts better to the changes in the material flow and is not so sensitive to local changes in the velocity. Owing to the relatively small area of the sensor element, the force directed to the sensor element by the flowing of materials with a lower density is minimal, so that the position of the sensor element

better represents the flowing of the heavier material with possibly more viscosity, i.e. the flowing of the concentrate.

The sensor element 1 is attempted to make as light-weight as possible, but so
5 that it has a required moment of mass inertia in order to achieve sufficient sensitivity. In the embodiment according to figures 2 and 3, the sensor element 1 is provided with a calibration means 4, such as a movable weight. The calibration means is locked in the sensor element, at a desired point by a locking screw 5. By means of said calibration means, the arrangement
10 according to the invention is calibrated to be suitable for each concentrate and/or application. The calibration takes place by setting the weight 4 at a desired point in the sensor element 1. By means of said calibration means, the mass inertia moment of the sensor element can thus be adjusted.

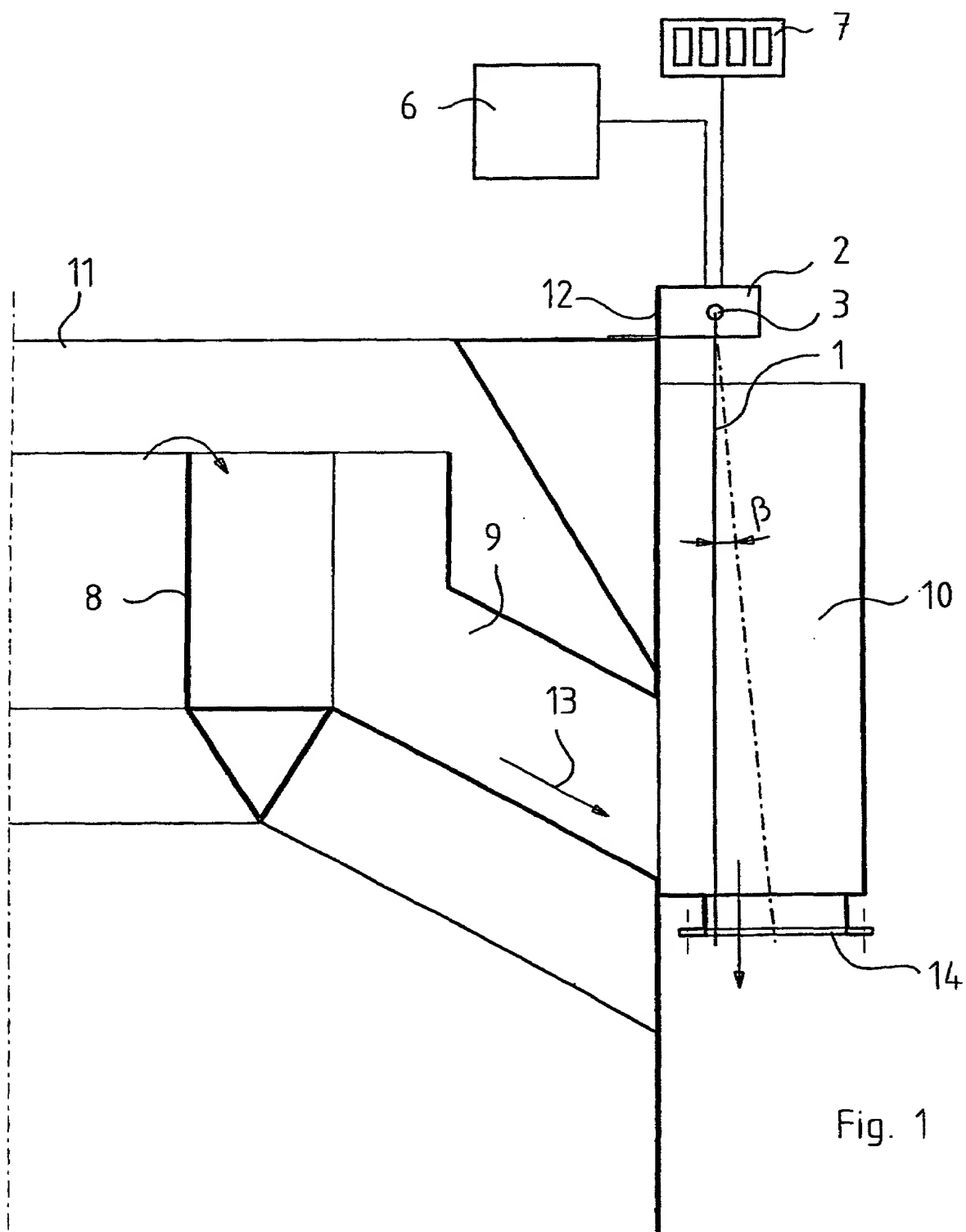
15 Typically the sensor element 1 is made of metal, for instance stainless or acid-proof steel, or of plastic. The sensor element can be a bar or a pipe. In cross-section, the sensor element 1 can have any shape that is suitable. The cross-sectional shape and measures of the sensor element vary according to the requirements set by the chosen material and by the target of
20 measurement.

For a man skilled in the art, it is obvious that the invention is not restricted to the above described embodiments, but it can be modified within the scope of the appended claims.

CLAIMS

1. An arrangement for measuring material flow, particularly concentrate flow, in connection with a flotation cell, **characterized** in that said arrangement
5 comprises an elongate sensor element (1) extending essentially over the whole transversal area of the material flow to be measured, and a measuring device (2) for detecting the position of the sensor element (1).
2. An arrangement according to claim 1, **characterized** in that the measuring
10 device (2) is an angle transmitter.
3. An apparatus according to claim 1 or 2, **characterized** in that the sensor element (1) is attached to the horizontal axis (3) of the measuring device (2).
- 15 4. An apparatus according to any of the preceding claims 1 - 3, **characterized** in that the horizontal axis (3) of the measuring device (2) is positioned essentially transversally to the flowing direction of the material flow to be measured.
- 20 5. An apparatus according to any of the preceding claims 1 - 4, **characterized** in that the arrangement is connected to the control system (6) of the flotation cell.
6. An apparatus according to any of the preceding claims 1 - 5, **characterized**
25 in that the arrangement comprises a display unit (7).
7. An apparatus according to any of the preceding claims 1 - 6, **characterized** in that the material flow to be measured is the material flow (13) flowing out of a flotation cell via a drain chute (8).

8. An apparatus according to any of the preceding claims 1 - 7, **characterized** in that in the sensor element (1), there is arranged a calibration means (4), such as a movable weight.
- 5 9. An apparatus according to any of the preceding claims 1 - 8, **characterized** in that the arrangement is provided in connection with the drain chute (8) of a flotation cell (11), preferably so that the sensor element (1) is at least partly placed in a collecting pipe (10).



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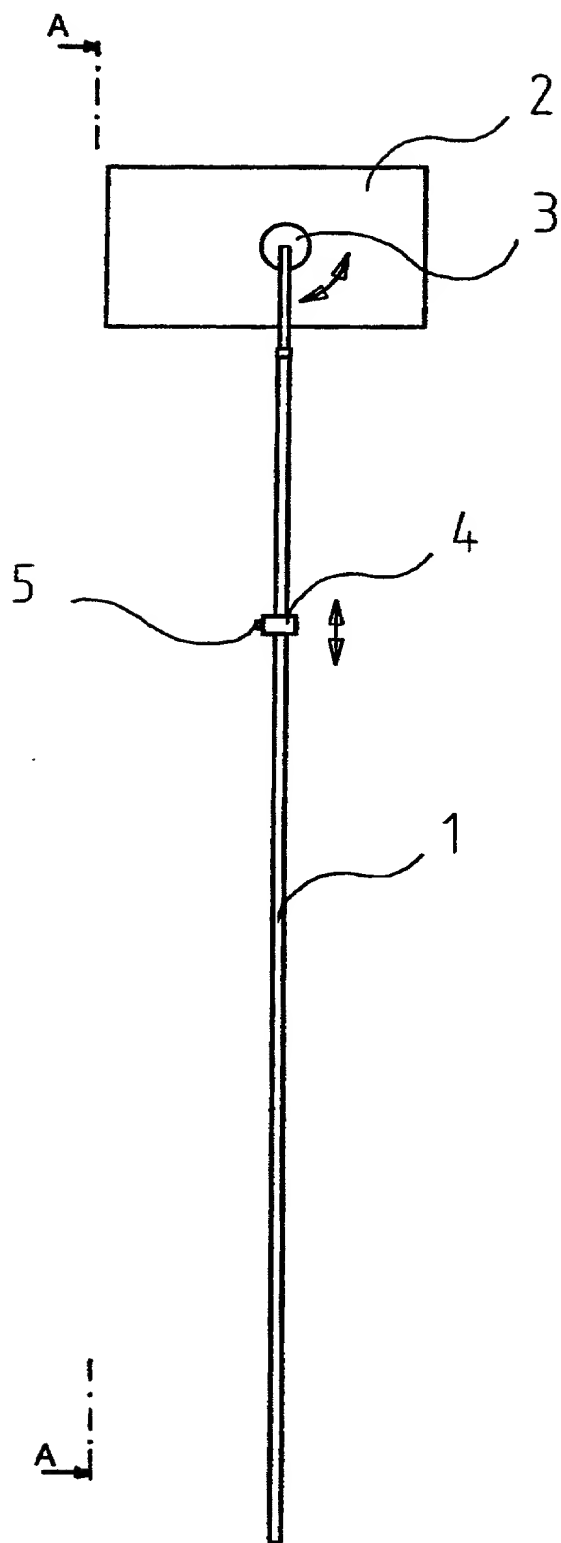


Fig. 2

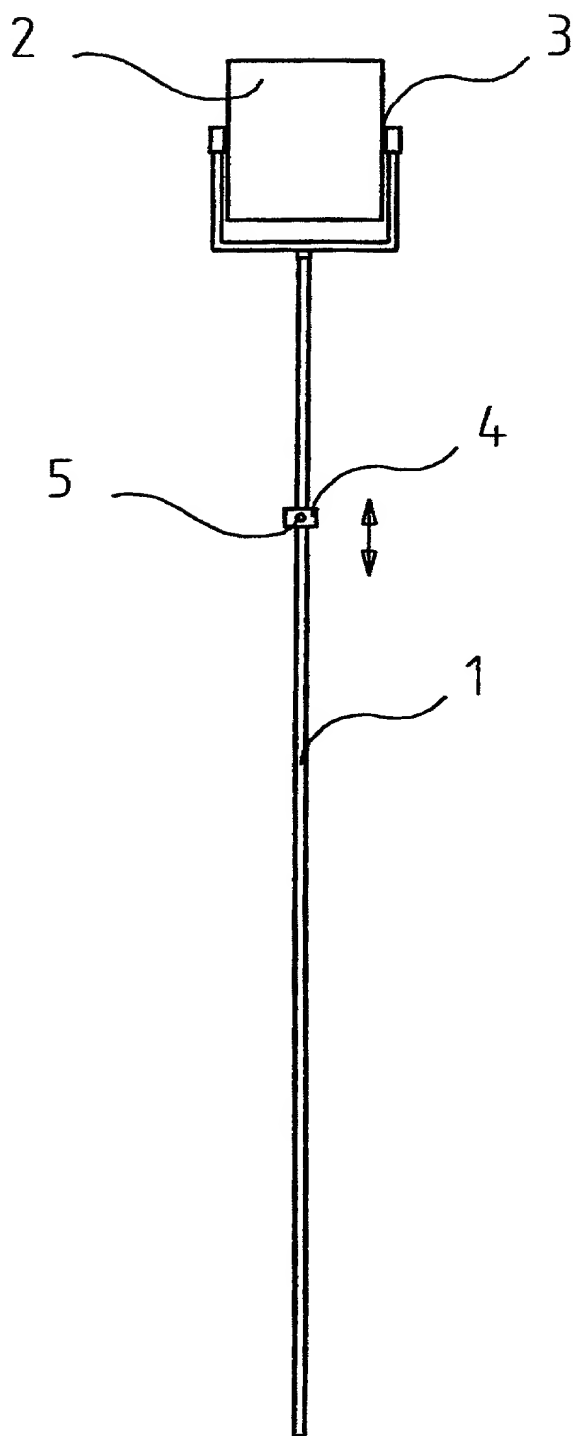


Fig. 3

Attorney's Docket No. _____

991484 US

JAN 2002



DECLARATION FOR PATENT APPLICATION
(COMBINED WITH POWER OF ATTORNEY)
(ORIGINAL APPLICATION)

COPY

As a non joint inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name. I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:
Arrangement for measuring concentrate flow in connection with a flotation cell

the specification of which is attached hereto unless box (a) or (b) is checked, in which case

- (a) ☐ the specification was filed on _____ as Application No. _____.
- (b) ☒ the specification was filed as PCT International Application No. PCT/FI00/00553 filed on 20 June 2000 and was amended under PCT Art. 19 on _____ (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Sec. 1.56.

I have identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America and filed less than 12 months (6 months for designs) prior to this United States application and of which I claim foreign priority benefits under Title 35, United States Code, Sec. 119, and I have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

EARLIEST FOREIGN APPLICATION, AND ALL FOREIGN APPLICATIONS FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

<u>Country</u>	<u>Application No.</u>	<u>Date of Filing</u> (month/day/year)
<u>Finland</u>	<u>991484</u>	<u>26 June 1999</u>
_____	_____	_____

As a named inventor, I hereby appoint the practitioners associated with ~~Customer Number 007812~~ (John Smith-Hill, Reg. No. 27,730 and Daniel J. Bedell, Reg. No. 30,156) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith and in connection with the resulting patent.

Send correspondence to the correspondence address associated with **Customer Number 007812**.

I hereby authorize the practitioners that I have appointed to accept instructions regarding this application and the resulting patent from OUTOKUMPU OYJ.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Title 18, United States Code, Sec. 1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first joint inventor _____

SAASTAMOINEN, Elias

Inventor's signature _____

Elias Saastamoinen

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201610-EE403660